

Patent Assignment Abstract of Title

Total Assignments: 1**Application #:** 09425788 **Filing Dt:** 10/22/1999**Patent #:** NONE**Issue Dt:****PCT #:** NONE**Publication #:** NONE**Pub Dt:****Inventors:** E. NOEL ABARRA, IWAO OKAMOTO, YOSHIFUMI MIZOSHITA**Title:** MAGNETIC RECORDING MEDIUM AND MAGNETIC STORAGE APPARATUS**Assignment: 1**

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| Reel/Frame: 010338/0169 | Received: 11/01/1999 | Recorded: 10/22/1999 | Mailed: 01/28/2000 | Pages: 3 |
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Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).**Assignors:** ABARRA, E. NOEL**Exec Dt:** 08/24/1999OKAMOTO, IWAO**Exec Dt:** 08/24/1999MIZOSHITA, YOSHIFUMI**Exec Dt:** 08/24/1999**Assignee:** FUJITSU LIMITED

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Patent Assignment Abstract of Title

Total Assignments: 3
Application #: 09416364 **Filing Dt:** 10/08/1999 **Patent #:** 6280813 **Issue Dt:** 08/28/2001

PCT #: NONE

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Pub Dt:
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Title: MAGNETIC RECORDING MEDIA WITH ANTIFERROMAGNETICALLY COUPLED FERROMAGNETIC FILMS AS THE RECORDING LAYER

Assignment: 1

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| Reel/Frame: <u>010311/0865</u> | Received: 10/20/1999 | Recorded: 10/08/1999 | Mailed: 01/12/2000 | Pages: 3 |
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Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

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| Reel/Frame: <u>013663/0348</u> | Received: 01/17/2003 | Recorded: 01/08/2003 | Mailed: 05/20/2003 | Pages: 13 |
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Assignment: 3

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Conveyance: CHANGE OF NAME (SEE DOCUMENT FOR DETAILS).

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| US 6280813 – claim 2 | 09/425,788 – claim 12 |
|---|--|
| 3 rd ferromagnetic layer 2 nd nonferromagnetic spacer 2 nd ferromagnetic layer nonferromagnetic spacer 1 st ferromagnetic layer | Magnetic layer Non-magnetic coupling layer 2 nd exch. structure Ferromagnetic layer Non-magnetic coupling layer 1 st exch. structure Ferromagnetic layer |
| substrate | *No substrate claimed but it is conventional in the art to provide a substrate to support the medium. See US 6565718, col. 1, line 65 to col. 2, line 15. |
| Magnetic moment per unit area of the 1 st ferromag. layer (M1t1 or Mrt1) not = to magnetic moment per unit area of the 2 nd ferromag. layer (M2t2 or Mrt2). 2 possibilities here: Mrt1>Mrt2 or Mrt1<Mrt2 | Remanent magnetization thickness product (Mrt) of the second exchange structure is smaller than that of the first exchange structure. i.e. Mrt1>Mrt2 |
| 1 st ferromagnetic layer is antiferromagnetically exchange coupled to the 2 nd ferromagnetic film and the 3 rd ferromagnetic film is antiferromagnetically exchange coupled to the 2 nd ferromagnetic film | Magnetizations of ferromagnetic layers of 1 st and 2 nd exchange structures are antiparallel The ferromagnetic layer underlying the magnetic layer and the magnetic layer have antiparallel magnetizations. (* "antiparallel" in this context is the equivalent of saying that the layers are antiferromagnetically coupled) |
| Magnetic recording structure exhibits a hysteresis loop with 2 remanent magnetic states in the absence of an applied magnetic field (Mr) – see ① and ② on attached copy of Figure 3 | *There are no claim limitations directed to the features of a hysteresis loop associated with this structure. However, Figure 6 of this application shows a hysteresis loop for the claimed structure that is very close in shape to the hysteresis loop set forth in Fig. 3 of US 6280813. Therefore, the structure set forth in the present claim inherently satisfies the limitations directed to the hysteresis loop set forth in claim 2 of US 6280813. |
| -Orientations of magnetic moments of 1 st and 2 nd ferromagnetic layers are antiparallel in each remanent state -1 st ferromagnetic film's moment orientation (→) in one remanent state is antiparallel to its orientation in the other remanent state (←) - see ③ and ④ on attached copy of Figure 3 | Based on this figure, it is clear that there are 2 remanent magnetic states in the absence of an applied field. The orientations of the magnetic moments of the ferromagnetic layers are not diagramed but appear to be inherent features of the claimed structure based on the shape of the hysteresis loop. |

| US 6280813 – claim 2 | 09/425,788 – claim 12 |
|---|--|
| 3 rd ferromagnetic layer 2 nd nonferromagnetic spacer 2 nd ferromagnetic layer nonferromagnetic spacer 1 st ferromagnetic layer | Magnetic layer Non-magnetic coupling layer } 2 nd exch. structure Ferromagnetic layer Non-magnetic coupling layer } 1 st exch. structure Ferromagnetic layer |
| substrate | *No substrate claimed but it is conventional in the art to provide a substrate to support the medium. See US 656718 , col. 1, line 65 to col. 2, line 15. <i>6565718</i> |
| Magnetic moment per unit area of the 1 st ferromag. layer (M1t1 or Mrt1) not = to magnetic moment per unit area of the 2 nd ferromag. layer (M2t2 or Mrt2). 2 possibilities here: Mrt1>Mrt2 or Mrt1<Mrt2 | Remanent magnetization thickness product (Mrt) of the second exchange structure is smaller than that of the first exchange structure. i.e. Mrt1>Mrt2 |
| 1 st ferromagnetic layer is antiferromagnetically exchange coupled to the 2 nd ferromagnetic film and the 3 rd ferromagnetic film is antiferromagnetically exchange coupled to the 2 nd ferromagnetic film | Magnetizations of ferromagnetic layers of 1 st and 2 nd exchange structures are antiparallel The ferromagnetic layer underlying the magnetic layer and the magnetic layer have antiparallel magnetizations. (* "antiparallel" in this context is the equivalent of saying that the layers are antiferromagnetically coupled) |
| Magnetic recording structure exhibits a hysteresis loop with 2 remanent magnetic states in the absence of an applied magnetic field (Mr) – see ① and ② on attached copy of Figure 4 | *There are no claim limitations directed to the features of a hysteresis loop associated with this structure. However, Figure 6 of this application shows a hysteresis loop that is very close in shape to the hysteresis loop set forth in Fig. 4 of US 6280813. <i>Therefore inherent</i> |
| - Orientations of magnetic moments of 1 st and 2 nd ferromagnetic layers are antiparallel in each remanent state - 1 st ferromagnetic film's moment orientation (→) in one remanent state is antiparallel to its orientation in the other remanent state (←) – see ③ and ④ on attached copy of Figure 4 | Based on this figure, it is clear that there are 2 remanent magnetic states in the absence of an applied field. The orientations of the magnetic moments of the ferromagnetic layers are not diagramed but appear to be inherent features of the claimed structure based on the shape of the hysteresis loop. |

US 6,280,813

Hysteresis loop

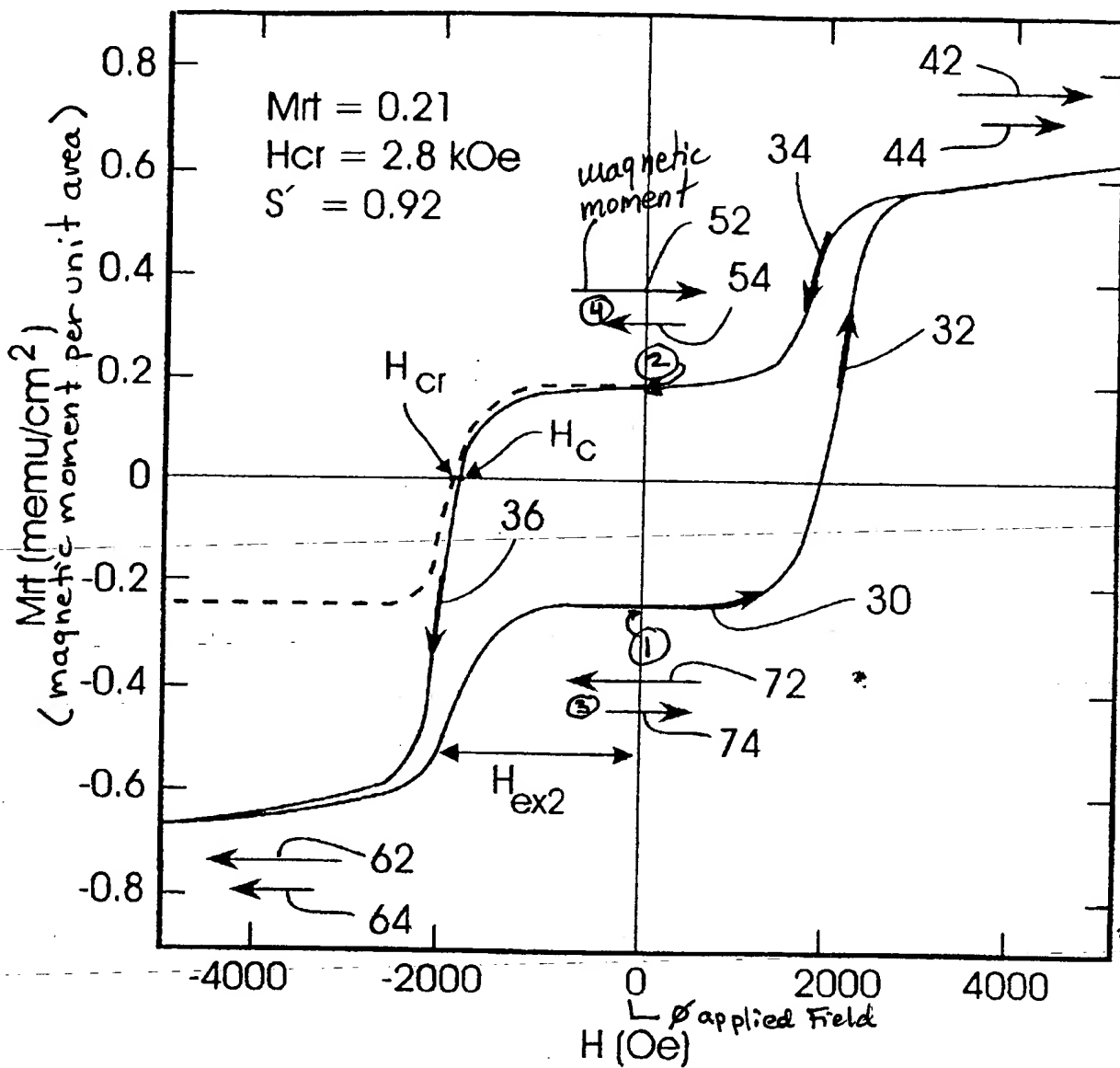


FIG. 4

① & ②: remanent state (M_r) = measure of magnetism in the absence of an applied magnetic field (H)

09/425,788

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FIG.6

Hysteresis loop

